AATRIZINVENTOR SOLUTION FOR INNOVATION BASED ON NATURE'S L.I.
Working Document to Build a Specific Solution.

INNOVATION CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

APLICATION OF NATURE'S LANGUAGE OF INNOVATION / Nature's L.I.
Web site: www.aatrizinventor.com
Reference book: The Nature's Language of Innovation, José Roberto Espinoza, Amazon, Kindle.
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FACTORS OF INNOVATION:
FUNCTION AFFECTED: Transportation of a traveler's suitcase affected by a heavy and bulky suitcase
PHYSICAL VARIABLE OR CHARACTERISTIC: Less Transportation quality
S1 OBJECT: SUITCASE Type: Moving
S2 OBJECT: TRAVELLER Type: Moving
DESIRED ACTION VERB: Improve

INNOVATION CHALLENGE:
CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase
DESIRED GOAL: More Transportation quality
EVALUATED OBJECT: SUITCASE
NEED TO SATISFY > 33. Ease of operation

SELECTED INNOVATION PARAMETERS TO EVALUATE:
A. UNDESIRABLE EFFECTS CAUSES OF DISSATISFACTION (UDEs)
There are More difficulty to Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase because:
SUITCASE Has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
SUITCASE Has More Own physical volume or accumulated quantitative volume or three-dimensional scope interacting with S2
SUITCASE Has Less Appropriate shape, composition, or configuration interacting with S2
SUITCASE Has More Loss of time or causes a bottleneck interacting with S2
There are undesirable effects that cause dissatisfaction because:
There is Less Transportation quality
B. DESIRED EFFECT FOR NEED TO SATISFY
There is More ease to Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase because:
SUITCASE Has More Desired ease of operation to interact with S2
There is desirable effect for need to satisfy because:
There is More Transportation quality

Table I. RELATIONSHIP WITH UNIVERSAL TRIZ INNOVATION PARAMETERS (maximum of 7

undesirable effects)
CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

This table presents the selected innovation parameters to evaluate the challenge that must be resolved for the interaction between an Object S1 and an Object S2, and no others. The choice of undesirable effects must be based on a thorough review of the current situation, identifying them based on the objective evidence present within the predefined space and time of evaluation. Fulfilling this requirement is crucial: If you do not connect the dots of the current situation properly, the algorithm will deliver a disconnected solution.

The selection of the need to satisfy should reflect the best estimation of the innovation-evolution state of the object S1 being evaluated.

Recognizing the criticality of this selection process, the Aatrizinventor algorithm provides flexibility to change parameters and conducts a sensitivity analysis in order to offer alternative solutions. These alternatives are based on different combinations of the entered parameters, also including a different need to satisfy from the one originally posed.

Parameters to evaluate(s)	It is understood as SUITCASE has:
Parámeters of undesirable effects (UDE):	**Undesirable effects causes of dissatisfaction:**
(+) 1. Heaviness of moving object	More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
(+) 7. Volume of moving object	More Own physical volume or accumulated quantitative volume or three-dimensional scope interacting with S2
(-) 12. Shape / composition / configuration	Less Appropriate shape, composition, or configuration interacting with S2
(+) 25. Loss of Time	More Loss of time or causes a bottleneck interacting with S2
Desirable parameter (DE):	**Desirable Effect for Need to satisfy:**
(+) 33. Ease of operation	More Desired ease of operation to interact with S2
TRIZ undesirables parameters for sensitivity analysis	**It is understood as SUITCASE has:**
(-) 9. Speed	Less Speed or rate of change interacting with S2
(-) 35. Adaptability or versatility	Less Adaptability or versatility to interaction variability of S2
n/a	
n/a	
n/a	

EVALUTION RESULTS TABLES

TABLE II. SPECIFIC CONTRADICTION MATRIX FOR UNDESIRABLE EFFECTS AND NEED TO SATISFY. FOR EVALUATED OBJECT: SUITCASE AND NEED TO BE SATISFIED > 33. Ease of operation
CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

(*) Preferred parameters: Improve 7. Volume of moving object & Attenuate or preserve 12. Shape / composition / configuration.
Contradictions/ E.C: Essential, Comp.:Complementary, Top 5: Up to the major fifth, noted if outside the preferred parameters.
Parameters in the first row are the same as those in the first column.

Parameter to attenuate or preserve => Parameter to improve	Var.	(+) Par.1	(+) Par.7	(-) **Par.12 PREF.**	(+) Par.25	(+) Par.33	Sum wt
(+) 1. Heaviness of moving object	wt		wt.13	**wt.7 Compl.**	wt.10	wt.19	50%
	IP(s)	0,0,0,0	29,2,40,28	10,14,35,40	10,35,20,28	35,3,2,24	
(+) 7. Volume of moving object PREF.	wt	**wt.16 Compl.**		**wt.1 E.C.**	**wt.5 Compl.**	**wt.20 Compl.**	87%
	IP(s)	2,26,29,40	0,0,0,0	1,15,29,4	2,6,34,10	15,13,30,12	
(-) 12. Shape / composition / configuration	wt	wt.11	wt.12		wt.15	wt.17	44%
	IP(s)	8,10,29,40	14,4,15,22	0,0,0,0	14,10,34,17	32,15,26,0	
(+) 25. Loss of Time	wt	wt.18	wt.6	**wt.14 Compl.**		**wt.2 Top 5**	65%
	IP(s)	10,20,37,35	2,5,34,10	4,10,34,17	0,0,0,0	4,28,10,34	
(+) 33. Ease of operation	wt	**wt.4 Top 5**	wt.8	**wt.9 Compl.**	**wt.2 Top 5**		81%
	IP(s)	25,2,13,15	1,16,35,15	15,34,29,28	4,28,10,34	0,0,0,0	
Sum wt		53%	60%	100%	71%	44%	

This table shows the essential contradiction (E.C.) that determines the solution strategy. Additionally, preferred parameters are established where complementary contradictions (Compl.) are found, allowing the definition of the Base Solution shown in Table III.
As a complement to the Base Solution, Table II also provides the following information that could be relevant to obtain an optimal solution:
a) The algorithm identifies the top 5 contradictions from the entire Table II and highlights those that are outside the preferred parameters for further review.
b) There are inventive principles present in Table II that are not part of the Recommended Solution

proposed in Table V. In the latter, the top three most relevant ones are highlighted, and the contradictions they involve are presented to evaluate whether they contribute significant aspects to the desired solution. For further details, Table VIII provides a prioritization of the inventive principles from Table II, and those not included in the Recommended Solution in Table V are marked with ***.

TABLE III. BASE SOLUTION FOR THE EVALUATED OBJECT: SUITCASE
NEED TO SATISFY > 33. Ease of operation
CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

Table II Selection: Essential Contradiction wt.1 y Complementary contradictions with preferred parameters (*) wt.5/wt.7/wt.9/wt.14							
Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
(+) 7. Volume of moving object	(-) 12. Shape / composition / configuration	Essential	wt.1	**1 Es.**	**15 Es.**	**29 Es.**	**4 Es.**
(+) 7. Volume of moving object	(+) 25. Loss of Time	Compl. 1	wt.5	2	6	34	10
(+) 1. Heaviness of moving object	(-) 12. Shape / composition / configuration	Compl. 2	wt.7	10	14	35	40
(+) 33. Ease of operation	(-) 12. Shape / composition / configuration	Compl. 3	wt.9	**15 Es.**	34	**29 Es.**	28
(+) 25. Loss of Time	(-) 12. Shape / composition / configuration	Compl. 4	wt.14	**4 Es.**	10	34	17

Inventive Principles (IP) selected for the Base Solution
IP.1. Segmenting/ Integrating - strategic type
IP.15. Dynamics - strategic type
IP.29. Controllable Soft Variables - tactical type
IP.4. Asymmetry/ Symmetry - **operative type**
IP.2. Taking out/ Adding - strategic type
IP.6. Universality - tactical type
IP.34. Discarding and Recovering - tactical type
IP.10. Preliminary Action - strategic type
IP.14. Spheroidality - Curvature - Angle - tactical type
IP.35. Transformation / Parameter Changes - strategic type
IP.40. Composite Materials/ Conditions - **operative type**
IP.28. Mechanics Substitution - strategic type
IP.17. Another Dimension or Field - tactical type

Table III shows the essential contradiction, the one with the highest weight, plus the following 4 complementary contradictions in weight, which are located in the row and column of the preferred

parameters selected in Table II. These contradictions are considered relevant for the solution and are described as the Base Solution in Table IX.

Keep in mind that all inventive principles selected for a solution must be evaluated according to the specific context of the contradictions in which they participate.

Inventive principles marked with 'Es.' correspond to inventive principles that belong to the essential contradiction.

TABLE IV. CONTRADICTION MATRIX COVERAGE FOR SOLUTION AMONG NEEDS TO SATISFY FOR EVALUATED OBJECT: SUITCASE, NEED TO BE SATISFY: 33. Ease of operation

Coverage is defined as the extent to which the inventive principles from Table II encompass the inventive principles from Table IV. If weighted coverage is higher, it has been observed that the obtained solution is more likely to have the lowest cost and the maximum benefit-to-cost ratio.

Parameter to improve	Parameter to preserve	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
33. Ease of operation	27. Reliability	17	**27 nT2**	8	40
33. Ease of operation	33. Ease of operation	0	0	0	0
33. Ease of operation	34. Ease of change, repair or maintain	12 nT3	26 nT3	1	32 nT3
33. Ease of operation	32. Ease of achieving desired outcome	2	5 nT3	12 nT3	0
33. Ease of operation	19. Use of energy by moving object	1	13 nT3	24 nT3	0
33. Ease of operation	39. Productivity	15	1	28	0
33. Ease of operation	38. Extent of automation/ autonomy	1	34	12 nT3	3 nT3
33. Ease of operation	35. Adaptability or versatility	15	34	1	16 nT3
33. Ease of operation	13. Stability	32 nT3	35	30 nT3	0
33. Ease of operation	15. Duration of action of moving object	29	3 nT3	8	25 nT3

Inventive Principles (IP) selected for the Solution of relevant Contradictions between Needs to Satisfy
IP.17. Another Dimension or Field - tactical type
IP.27. Cheap Short-Living Objects - strategic tpe
IP.8. Anti-Weight/ Compensation - tactical type
IP.40. Composite Materials/ Conditions - **operative type**

97.59 % weighted coverage of the inventive principles (IP) included in Table IV. of Contradictions between Needs to Satisfy (NS), in relation to the IP included in Table II Specific Contradiction Matrix.

The inventive principles labeled with nT2 are not found in Table II. Due to this condition, the first three contradictions in Table IV containing principles marked with nT2 are described as a Solution among Needs to Satisfy in Table IX. This solution, combined with the previously mentioned Base Solution, forms the Recommended Solution by the Aatrizinventor Algorithm, shown in Table V.

From practical experience, if Table IV contains more than 3 contradictions with inventive principles not included in Table II, then it is likely to be more challenging to construct a specific solution. In that case, it is recommended to look for an alternative combination of parameters in Table VI of sensitivity analysis. It is also an option to select another need to satisfy, which is shown in Table VII Essential Contradictions of Needs to Satisfy (NS) for the same undesirable effects already evaluated for SUITCASE.

To evaluate the recommended inventive principles here and the corresponding contradictions in which they participate, it is necessary for the Base Solution to guide an initial context for the solution, as the contradictions between Needs to Satisfy do not identify which variable of the evaluated object S1 should be operated.

Inventive principles labeled with nT3 are included in Table II, but do not participate in the Recommended Solution shown in Table V. The Innovation Team must review the contradictions where they participate, to determine if there were other specific aspects that could be significant for the solution.

Unmarked inventive principles are included in Table II Specific Contradiction Matrix and in Table V Recommended Solution.

TABLE V. RECOMMENDED SOLUTION FOR INNOVATION CHALLENGE FOR EVALUATED OBJECT SUITCASE

CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase
Evaluated need to satisfy in this report: **33. Ease of operation**
UDEs: (+) 1. Heaviness of moving object// (+) 7. Volume of moving object// (-) 12. Shape / composition / configuration// (+) 25. Loss of Time

Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
(+) 7. Volume of moving object	(-) 12. Shape / composition / configuration	Essential	wt.1	**1 Es.**	**15 Es.**	**29 Es.**	**4 Es.**
(+) 7. Volume of moving object	(+) 25. Loss of Time	Compl. 1	wt.5	2	6	34	10
(+) 1. Heaviness of moving object	(-) 12. Shape / composition / configuration	Compl. 2	wt.7	10	14	35	40
(+) 33. Ease of operation	(-) 12. Shape / composition / configuration	Compl. 3	wt.9	**15 Es.**	34	**29 Es.**	28
(+) 25. Loss of Time	(-) 12. Shape / composition / configuration	Compl. 4	wt.14	**4 Es.**	10	34	17
33. Ease of operation	27. Reliability	NS.1	wns.1	17	27	8	40

Relevant inventive principles from Table II not included in Recommended Solution

Before deciding on the solution, make sure you have previously reviewed the contradictions with relevant Inventive Principles from Table II, not included in the Recommended Solution. The 3 most relevant are shown below.

IP.32. Perception/ Appearance/ Color Changes (Pos.9) ***	IP. Str.	[Par.12][Par.33][IP(s) : 32,15,26,0] -
IP.25. Self-service (Pos.10) ***	**IP. Oper.**	[Par.33][Par.1][IP(s) : 25,2,13,15] -
IP.26. Copying/ Replicating (Pos.14) ***	IP. Str.	[Par.7][Par.1][IP(s) : 2,26,29,40] - [Par.12][Par.33][IP(s) : 32,15,26,0] -

Inventive Principles (IP) selected for Recommended Solution:

To develop a Specific Solution based on the contradictions provided in Table V, where S1: SUITCASE interacts with S2: TRAVELLER, the Innovation Team must analyze the recommended innovation concepts for each selected inventive principle listed below. At least one concept from each principle that is applicable to the challenge under evaluation should be chosen.

Once the concepts are selected per inventive principle, it is essential to conduct an 'integrated reading' of the contradictions indicated in Table V. If this 'integrated reading' can demonstrate a coherent logical thread for each selected contradiction and as a whole, then it can be considered that there is a potential innovation solution.

To complete the definition of the specific solution, it is necessary to review the relevant inventive principles from Table II that were not included in the Recommended Solution in Table V, which are presented above.

For more details on the selected contradictions, you can review the complete descriptions of the inventive principles by contradiction, as shown in Table IX.

In the Starting Manual, Fundamentals of Aatrizinventor, Point 11, an example is provided for developing the Specific Solution based on the Recommended Solution by the Aatrizinventor algorithm, based on the 'Language of Nature Innovation.' The identification of a specific solution is a systematic and iterative process involving multiple concepts, aiming to determine a comprehensive solution with minimal implementation costs and maximum benefit-to-cost ratio.

It's important noting that an asterisk (*) has been added to the name of the object under evaluation to remind that the descriptions of the inventive principles may consider that SUITCASE can be in its current physical and functional state, or in a modified state, or even in a new state, as needed to achieve the desired objective. Please, make the most of your relational thinking skills.

Summary description of the Inventive Principles included in the Recommended Solution shown above, applicable to the challenge under evaluation for the defined space and time:

N°1 Improve: (+) 7. Volume of moving object and Attenuate or Preserve: (-) 12. Shape / composition / configuration

IP.1. Segmenting/ Integrating - strategic type (1)

a. Divide SUITCASE* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different existing or new parts, forms, phases, states or conditions of SUITCASE* in a single entity.

c. Make SUITCASE* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of SUITCASE*.

IP.15. Dynamics - strategic type (2)

a. Allow (or design) the characteristics of SUITCASE*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide SUITCASE* into parts that are capable of relative movement between each other.

c. If SUITCASE* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of SUITCASE* or the process, use feature(s) or object(s) available in the nearby environment.

IP.29. Controllable Soft Variables - tactical type (3)

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with SUITCASE* facilitating goal fulfillment of the function performed with Object S2.

b. Make easier SUITCASE* interact with Object S2 using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

IP.4. Asymmetry/ Symmetry - operative type (4)

a. Change the shape of SUITCASE* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.

b. If SUITCASE* is asymmetrical, increase its degree of asymmetry, or vice versa.

N°2 Improve: (+) 7. Volume of moving object and Attenuate or Preserve: (+) 25. Loss of Time

IP.2. Taking out/ Adding - strategic type (5)

a. Separate an interfering part or a property from SUITCASE*, or single out the only necessary part (or property) of SUITCASE*. **b.** Add new parts or properties to SUITCASE*.

IP.6. Universality - tactical type (6)

a. Make a part or the whole of SUITCASE* perform multiple functions.

b. Eliminate the need of SUITCASE* for others parts.

IP.34. Discarding and Recovering - tactical type (7)

a. Make portions of SUITCASE*, which have fulfilled their functions or are unnecessary, go away (discard by absorption, dissolving, evaporating, et**c.**).

b. Conversely, restore consumable parts of SUITCASE* directly in operation.

IP.10. Preliminary Action - strategic type (8)

a. Perform the required change in, or for, SUITCASE*, before it is needed (either fully or partially).

b. Pre-arrange SUITCASE* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

N°3 Improve: (+) 1. Heaviness of moving object and Attenuate or Preserve: (-) 12. Shape / composition / configuration

IP.10. Preliminary Action - strategic type (9)

a. Perform the required change in, or for, SUITCASE*, before it is needed (either fully or partially).

b. Pre-arrange SUITCASE* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

IP.14. Spheroidality - Curvature - Angle - tactical type (10)

a. For the interaction between SUITCASE* and Object S2, instead of using rectilinear parts, surfaces, or shapes, use curvilinear, enveloping, or angled parts.

b. For the interaction between SUITCASE* and Object S2, instead of acting in a linear or direct way, interact in an indirect way or with curvilinear, surrounding, or angled movements.

c. Move SUITCASE* from flat to spherical surfaces; from parts shaped as a cube (parallelepiped) to ball-shaped structures. **d.** Use rolls, balls, spirals, domes in, or for, SUITCASE*.

e. Go from linear to rotary motion, use centrifugal forces in, or for, SUITCASE*.

f. If there is Spheroidality , curvature or angle, increase or reduce, as applicable, in, or for, SUITCASE*.

IP.35. Transformation / Parameter Changes - strategic type (11)

a. Change SUITCASE*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of SUITCASE* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of SUITCASE*.

IP.40. Composite Materials/ Conditions - operative type (12)

a. Change from a uniform material, property, state, or condition in, or for, SUITCASE* , to a composite one, or vice versa.

N°4 Improve: (+) 33. Ease of operation and Attenuate or Preserve: (-) 12. Shape / composition / configuration

IP.15. Dynamics - strategic type (13)

a. Allow (or design) the characteristics of SUITCASE*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide SUITCASE* into parts that are capable of relative movement between each other.

c. If SUITCASE* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of SUITCASE* or the process, use feature(s) or object(s) available in the nearby environment.

IP.34. Discarding and Recovering - tactical type (14)

a. Make portions of SUITCASE*, which have fulfilled their functions or are unnecessary, go away (discard by absorption, dissolving, evaporating, et**c.**).

b. Conversely, restore consumable parts of SUITCASE* directly in operation.

IP.29. Controllable Soft Variables - tactical type (15)

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with SUITCASE* facilitating goal fulfillment of the function performed with Object S2.

b. Make easier SUITCASE* interact with Object S2 using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

IP.28. Mechanics Substitution - strategic type (16)

a. Replace a direct or manual action in, or for, SUITCASE*, with a mechanical action or a tool.

b. Replace a mechanical means in, or for, SUITCASE*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.

c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields gto improve action of SUITCASE*.

d. Change from static fields in, or for, SUITCASE* to moving fields, from unstructured fields to those with structure, or vice versa.

e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, SUITCASE*.

N°5 Improve: (+) 25. Loss of Time and Attenuate or Preserve: (-) 12. Shape / composition / configuration
IP.4. Asymmetry/ Symmetry - operative type (17)
a. Change the shape of SUITCASE* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.
b. If SUITCASE* is asymmetrical, increase its degree of asymmetry, or vice versa.
IP.10. Preliminary Action - strategic type (18)
a. Perform the required change in, or for, SUITCASE*, before it is needed (either fully or partially).
b. Pre-arrange SUITCASE* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.
IP.34. Discarding and Recovering - tactical type (19)
a. Make portions of SUITCASE*, which have fulfilled their functions or are unnecessary, go away (discard by absorption, dissolving, evaporating, et**c.**).
b. Conversely, restore consumable parts of SUITCASE* directly in operation.
IP.17. Another Dimension or Field - tactical type (20)
a. Add or remove physical dimensions or fields of action of SUITCASE*.
b. Move SUITCASE* to a new dimension in space or performance field.
c. Use for SUITCASE* multi-story arrangement of objects instead of a single-story arrangement.
d. Tilt or re-orient SUITCASE*; lay it on its side.
e. Use another side of a given dimension or field of SUITCASE*.

N°6 Improve: 33. Ease of operation and Preserve: 27. Reliability
IP.17. Another Dimension or Field - tactical type (21)
a. Add or remove physical dimensions or fields of action of SUITCASE*.
b. Move SUITCASE* to a new dimension in space or performance field.
c. Use for SUITCASE* multi-story arrangement of objects instead of a single-story arrangement.
d. Tilt or re-orient SUITCASE*; lay it on its side.
e. Use another side of a given dimension or field of SUITCASE*.
IP.27. Cheap Short-Living Objects - strategic type (22)
a. Replace or divide (either fully or partially) SUITCASE* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.
b. Compress certain qualities of SUITCASE* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.
IP.8. Anti-Weight/ Compensation - tactical type (23)
a. To compensate for the heaviness/lightness or incidence of SUITCASE*, merge it with other objects or independent own parts that provide an effect to improve the current situation.

b. To compensate for the heaviness/lightness or incidence of SUITCASE*, make it interact with the environment.

IP.40. Composite Materials/ Conditions - operative type (24)

a. Change from a uniform material, property, state, or condition in, or for, SUITCASE* , to a composite one, or vice versa.

N°7 Improve: and Preserve:

N°8 Improve: and Preserve:

Relevant inventive principles from Table II not included in Recommended Solution

IP.32. Perception/ Appearance/ Color Changes (Pos.(9) - strategic type (25)

a. Change how is perceived, the appearance or shape of SUITCASE* in relation to the object S2 with which it interacts.

b. Change the color, or appearance, of SUITCASE* or its external environment.

c. Change the transparency of SUITCASE* or its external environment.

IP.25. Self-service (Pos.(10) - operative type (26)

a. Make SUITCASE* serve itself by performing helpful auxiliary functions.

b. Use resources, energy or substances that are wasted or unused by SUITCASE*. **c.** Incorporate resources and/or functions into SUITCASE* for self-service during operation.

IP.26. Copying/ Replicating (Pos.(14) - strategic type (27)

a. Instead of using SUITCASE*, or any of its unavailable, expensive, fragile parts or properties, use simpler and inexpensive copies or replicates to perform the desired function and, if possible, do so with improved characteristics and properties, while disregarding the harmful, undesirable, or unnecessary ones.

b. Imitate SUITCASE*, or any of its parts or properties, leveraging the relevant available environment.

c. If simple copies, or replicates are already being used, apply copies, or replicates of a higher level or technical

TABLE VI. RESULTS OF SENSITIVITY ANALYSIS FOR THE EVALUATED OBJECT SUITCASE

CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

Coverage obtained for the current evaluation to compare with sensitivity analysis

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)
#	1	7	12	25	33. Ease of operation	97.59	24.04	79.2

Table VI presents the 10 most favorable parameter combinations recommended by the Aatrizinventor algorithm. It is suggested to evaluate the 2 or 3 most relevant ones. Practice teaches that they often contain the best solution for the evaluated challenge.

(E) Combination of TRIZ innovation parameters evaluated in this Aatrizinventor Solution is prioritized here

A. PRIORITISED CONTRADICTIONS BY GLOBAL COVERAGE (Cob.GL)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)
I.a	1	7	9	25	27. Reliability	95.25	100	96.43
II.a	1	9	12	35	27. Reliability	95.25	100	96.43
III.a	1	9	25	35	27. Reliability	95.25	100	96.43
IV.a	1	7	9	0	27. Reliability	95.25	100	96.43
V.a	1	9	35	0	27. Reliability	95.25	100	96.43

B. PRIORITIZATION OF CONTRADICTIONS BY COVERAGE OF NEEDS TO SATISFY (Cob.NS)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)	Table VI.A
I.b	1	7	12	25	33. Ease of operation **(E)**	97.59	24.04	79.2	-
II.b	1	9	25	35	34. Ease of change, repair or maintain	97.59	7.94	75.17	-
III.b	1	9	12	25	27. Reliability	97.25	43.44	83.8	-
IV.b	1	7	25	35	34. Ease of change, repair or maintain	96.72	44.1	83.57	-
V.b	7	9	25	35	34. Ease of change, repair or maintain	96.72	10.03	75.05	-

TABLE VII ESSENTIAL CONTRADICTIONS MATRIX FOR NEEDS TO SATISFY (NS) FOR THE SAME UNDESIRABLE EFFECTS EVALUATED OF: SUITCASE

CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

Evaluated need to satisfy in this report: **33. Ease of operation**

UDEs: (+) 1. Heaviness of moving object// (+) 7. Volume of moving object// (-) 12. Shape / composition / configuration// (+) 25. Loss of Time

This table allows the Innovation Team to compare the coverages obtained for the evaluated need to satisfy with those of the other defined needs, for the same undesirable effects. This way, they can decide whether to choose any of the suggested innovation parameter combinations here that offer better coverage.

Need to Satisfy	Parameter to improve	Parameter to attenuate or preserve	Contradict. Essential	Cob. NS (%)	Cob. between EC (%)	Cob. GL (%) 3/1

34. Ease of change, repair or maintain	(+) 34. Ease of change, repair or maintain	(+) 25. Loss of Time	[32,1,10,25]	87.06	100	90.3
39. Productivity	(+) 7. Volume of moving object	(+) 39. Productivity	[10,6,2,34]	88.48	58.08	80.88
33. Ease of operation	(+) 7. Volume of moving object	(-) 12. Shape / composition / configuration	[1,15,29,4]	97.59	24.04	79.2
19. Use of energy by moving object	(+) 1. Heaviness of moving object	(-) 12. Shape / composition / configuration	[10,14,35,40]	85.74	48.57	76.45
38. Extent of automation/ autonomy	(+) 1. Heaviness of moving object	(+) 25. Loss of Time	[10,35,20,28]	75.73	64.55	72.94
32. Ease of achieving desired outcome	(+) 32. Ease of achieving desired outcome	(-) 12. Shape / composition / configuration	[1,28,13,27]	90.38	14.05	71.3
27. Reliability	(+) 1. Heaviness of moving object	(-) 12. Shape / composition / configuration	[10,14,35,40]	77.36	48.57	70.16
13. Stability	(+) 1. Heaviness of moving object	(+) 25. Loss of Time	[10,35,20,28]	64.9	64.55	64.82
15. Duration of action of moving object	(+) 25. Loss of Time	(+) 7. Volume of moving object	[2,5,34,10]	64.14	58.08	62.62
35. Adaptability or versatility	(+) 7. Volume of moving object	(-) 12. Shape / composition / configuration	[1,15,29,4]	65.24	24.04	54.94

Table VII shows the essential contradictions obtained for each of the defined Needs to Satisfy, taking into account the same undesirable effects that have been evaluated. This table is based on the calculation of a global coverage (Cob.GL), which is determined by combining two values: the coverage from Table IV (Cob.NS) already explained, and a relative coverage (Cob. between EC) that is obtained in this table VII, when each other comparing the essential contradictions identified for the 10 parameters of Needs to Satisfy.

This global coverage (GL) is based on expert weighting criteria to prioritize the solutions for the different Needs to Satisfy. Experience with aatrizinventor indicates that the most effective solutions are those with higher global coverage, preferably exceeding 90%, if possible.

The Innovation Team may decide if it is appropriate to carry out a new evaluation with another Need to Satisfy, selected from the results provided in Table VII. This decision will be primarily made when the

evaluated Need to Satisfy is not ranked in the first position of Table VII. In this table, the position of the evaluated Need to Satisfy is highlighted: 33. Ease of operation.

TABLE VIII. ORDER OF INCIDENCE OF INVENTIVE PRINCIPLES (POS.n)

CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase
Participation analysis of inventive principles in TABLE II SPECIFIC CONTRADICTION MATRIX.
Evaluated parameters for Object SUITCASE:
Par. UDEs:
(+) 1. Heaviness of moving object
(+) 7. Volume of moving object
(-) 12. Shape / composition / configuration
(+) 25. Loss of Time
Par. NS: (+) 33. Ease of operation

***: Inventive Principles from the Specific Contradiction Matrix (Table II) not described in the Recommend Solution (Table IX). It is recommended to perform an additional review following the order of position.

Inventive principles of Table II	IP type	Tables	Contradictions
IP.10. Preliminary Action (Pos.1)	IP. Str.	II / III /	[Par.12][Par.1][IP(s) : 8,10,29,40] - [Par.25][Par.1][IP(s) : 10,20,37,35] - [Par.25][Par.7][IP(s) : 2,5,34,10] - [Par.1][Par.12][IP(s) : 10,14,35,40] - [Par.25][Par.12][IP(s) : 4,10,34,17] - [Par.1][Par.25][IP(s) : 10,35,20,28] - [Par.7][Par.25][IP(s) : 2,6,34,10] - [Par.12][Par.25][IP(s) : 14,10,34,17] - [Par.33][Par.25][IP(s) : 4,28,10,34] - [Par.25][Par.33][IP(s) : 4,28,10,34] -
IP.2. Taking out/ Adding (Pos.2)	IP. Str.	II / III / IV	[Par.7][Par.1][IP(s) : 2,26,29,40] - [Par.33][Par.1][IP(s) : 25,2,13,15] - [Par.1][Par.7][IP(s) : 29,2,40,28] - [Par.25][Par.7][IP(s) : 2,5,34,10] - [Par.7][Par.25][IP(s) : 2,6,34,10] - [Par.1][Par.33][IP(s) : 35,3,2,24] -
IP.4. Asymmetry/ Symmetry (Pos.3)	**IP. Oper.**	II / III /	[Par.12][Par.7][IP(s) : 14,4,15,22] - [Par.7][Par.12][IP(s) : 1,15,29,4] - [Par.25][Par.12][IP(s) : 4,10,34,17] - [Par.33][Par.25][IP(s) : 4,28,10,34] - [Par.25][Par.33][IP(s) : 4,28,10,34] -
IP.15. Dynamics (Pos.4)	IP. Str.	II / III / IV	[Par.33][Par.1][IP(s) : 25,2,13,15] - [Par.12][Par.7][IP(s) : 14,4,15,22] - [Par.33][Par.7][IP(s) : 1,16,35,15] - [Par.7][Par.12][IP(s) : 1,15,29,4] - [Par.33][Par.12][IP(s) : 15,34,29,28] - [Par.7][Par.33][IP(s) : 15,13,30,12] - [Par.12][Par.33][IP(s) : 32,15,26,0] -
IP.14. Spheroidality - Curvature - Angle (Pos.5)	IP. Tac.	II / III /	[Par.12][Par.7][IP(s) : 14,4,15,22] - [Par.1][Par.12][IP(s) : 10,14,35,40] - [Par.12][Par.25][IP(s) : 14,10,34,17] -

IP.1. Segmenting/ Integrating (Pos.6)	IP. Str.	II / III / IV	[Par.33][Par.7][IP(s) : 1,16,35,15] - [Par.7][Par.12][IP(s) : 1,15,29,4] -
IP.35. Transformation / Parameter Changes (Pos.7)	IP. Str.	II / III / IV	[Par.25][Par.1][IP(s) : 10,20,37,35] - [Par.33][Par.7][IP(s) : 1,16,35,15] - [Par.1][Par.12][IP(s) : 10,14,35,40] - [Par.1][Par.25][IP(s) : 10,35,20,28] - [Par.1][Par.33][IP(s) : 35,3,2,24] -
IP.29. Controllable Soft Variables (Pos.8)	IP. Tac.	II / III / IV	[Par.7][Par.1][IP(s) : 2,26,29,40] - [Par.12][Par.1][IP(s) : 8,10,29,40] - [Par.1][Par.7][IP(s) : 29,2,40,28] - [Par.7][Par.12][IP(s) : 1,15,29,4] - [Par.33][Par.12][IP(s) : 15,34,29,28] -
IP.32. Perception/ Appearance/ Color Changes (Pos.9) ***	IP. Str.	II / IV	[Par.12][Par.33][IP(s) : 32,15,26,0] -
IP.25. Self-service (Pos.10) ***	**IP. Oper.**	II / IV	[Par.33][Par.1][IP(s) : 25,2,13,15] -
IP.8. Anti-Weight/ Compensation (Pos.11)	IP. Tac.	II / IV	[Par.12][Par.1][IP(s) : 8,10,29,40] -
IP.34. Discarding and Recovering (Pos.12)	IP. Tac.	II / III / IV	[Par.25][Par.7][IP(s) : 2,5,34,10] - [Par.25][Par.12][IP(s) : 4,10,34,17] - [Par.33][Par.12][IP(s) : 15,34,29,28] - [Par.7][Par.25][IP(s) : 2,6,34,10] - [Par.12][Par.25][IP(s) : 14,10,34,17] - [Par.33][Par.25][IP(s) : 4,28,10,34] - [Par.25][Par.33][IP(s) : 4,28,10,34] -
IP.28. Mechanics Substitution (Pos.13)	IP. Str.	II / III / IV	[Par.1][Par.7][IP(s) : 29,2,40,28] - [Par.33][Par.12][IP(s) : 15,34,29,28] - [Par.1][Par.25][IP(s) : 10,35,20,28] - [Par.33][Par.25][IP(s) : 4,28,10,34] - [Par.25][Par.33][IP(s) : 4,28,10,34] -
IP.26. Copying/ Replicating (Pos.14) ***	IP. Str.	II / IV	[Par.7][Par.1][IP(s) : 2,26,29,40] - [Par.12][Par.33][IP(s) : 32,15,26,0] -
IP.20. Continuity of Useful Action (Pos.15) ***	**IP. Oper.**	II /	[Par.25][Par.1][IP(s) : 10,20,37,35] - [Par.1][Par.25][IP(s) : 10,35,20,28] -
IP.13. Reverse or Indirect Action (Pos.16) ***	IP. Str.	II / IV	[Par.33][Par.1][IP(s) : 25,2,13,15] - [Par.7][Par.33][IP(s) : 15,13,30,12] -
IP.16. Partial or Excessive Actions (Pos.17) ***	**IP. Oper.**	II / IV	[Par.33][Par.7][IP(s) : 1,16,35,15] -
IP.6. Universality (Pos.18)	IP. Tac.	II / III /	[Par.7][Par.25][IP(s) : 2,6,34,10] -

IP.5. Merging/ Separating (Pos.19) ***	**IP. Oper.**	II / IV	[Par.25][Par.7][IP(s) : 2,5,34,10] -
IP.3. Local Quality (Pos.20) ***	IP. Str.	II / IV	[Par.1][Par.33][IP(s) : 35,3,2,24] -
IP.40. Composite Materials/ Conditions (Pos.21)	**IP. Oper.**	II / III / IV	[Par.7][Par.1][IP(s) : 2,26,29,40] - [Par.12][Par.1][IP(s) : 8,10,29,40] - [Par.1][Par.7][IP(s) : 29,2,40,28] - [Par.1][Par.12][IP(s) : 10,14,35,40] -
IP.37. Useful Perceptible Change (Pos.22) ***	**IP. Oper.**	II /	[Par.25][Par.1][IP(s) : 10,20,37,35] -
IP.30. Simple Shapes/ Ways to Interact (Pos.23) ***	IP. Tac.	II / IV	[Par.7][Par.33][IP(s) : 15,13,30,12] -
IP.17. Another Dimension or Field (Pos.24)	IP. Tac.	II / III / IV	[Par.25][Par.12][IP(s) : 4,10,34,17] - [Par.12][Par.25][IP(s) : 14,10,34,17] -
IP.24. Intermediary (Pos.25) ***	IP. Tac.	II / IV	[Par.1][Par.33][IP(s) : 35,3,2,24] -
IP.22. Convert harm in benefit (Pos.26) ***	IP. Str.	II /	[Par.12][Par.7][IP(s) : 14,4,15,22] -
IP.12. Equipotentiality (Pos.27) ***	IP. Tac.	II / IV	[Par.7][Par.33][IP(s) : 15,13,30,12] -

TABLE IX. RECOMMENDED SOLUTION ACCORDING TO THE MOST RELEVANT CONTRADICTIONS IDENTIFIED FOR THE EVALUATED OBJECT: SUITCASE

CHALLENGE: Improve Transportation of a traveler's suitcase affected by a heavy and bulky suitcase

This table displays the relevant contradictions identified by the algorithm, which are crucial for determining the direction and scope of the solution to the innovation challenge under evaluation. The specific solution will be obtained by applying the updated inventive principles detailed below.

It is essential to bear in mind that we are evaluating SUITCASE when it interacts with TRAVELLER and there is an affected function: Transportation of a traveler's suitcase affected by a heavy and bulky suitcase, in a specific space and time. SUITCASE may require changes in space, time, its physical composition, or its functional characteristic, as well as partial or total replacement with another object or other recommended changes. To emphasize this concept, we mark SUITCASE with an asterisk. Do not read the name of the evaluated object literally; associate it with a possible solution for SUITCASE*.

Each inventive principle described here may contain more than one innovation concept recommended by TRIZ, identified as a, b, c, ..., not all of which are applicable to a specific case under evaluation. The Innovation Team must select those innovation concepts that best relate to the evaluated innovation challenge, based on their own knowledge and the analysis of relational thinking that they must carry out.

Additionally, technological research may be necessary for its solution, as the specific solution recommended by the inventive principles described here likely already exists somewhere in the world. The interpretation of the inventive principles, to apply them specifically to the evaluated case, is a recursive process that generally ranges from strategic to tactical and operational levels. We recommend completing the reading of the inventive principles described below to envision a possible solution and then rereading the principles to reinforce the coherence of the emerging solution. As a result of the finally determined innovation solution, there will be a change in SUITCASE, in a new context guided by the inventive principles, probably not previously imagined.

The Language of Nature's Innovation provides speed and focus for guided and systematic innovation thinking for individuals. The foundation for innovation is a profound understanding of the current situation.

IX.A BASE SOLUTION FOR INNOVATION CHALLENGE FOR THE EVALUATED OBJECT SUITCASE
NEED TO SATISFY: 33. Ease of operation
Strategic inventive principles: Str. IP
Tactical inventive principles: Tac. IP
Operative inventive principles: Oper. IP
Pos.n : Order of importance n of an inventive principle included in Table II.

ESSENTIAL CONTRADICTION
Contradiction order wt.1

Parameter to improve: (+) 7. Volume of moving object
TO IMPROVE (UDE): SUITCASE has More Own physical volume or accumulated quantitative volume or three-dimensional scope interacting with S2
Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration
TO ATTENUATE OR PRESERVE (UDE): SUITCASE has Less Appropriate shape, composition, or configuration interacting with S2
Inventive principles IP(s) : [1,15,29,4]
1. Segmenting/ Integrating, Str. IP (Pos.6):
a. Divide SUITCASE* into existing and/or new parts, shapes, phases, states, or conditions.
b. Integrate different parts, shapes, phases, states, or existing or new conditions of a SUITCASE* into a single entity..
c. Make SUITCASE* easy to disassemble or assemble.
d. Increase or reduce the degree of fragmentation or segmentation of SUITCASE*.
Separation principle for SUITCASE* : Separation in space / Separation in subsystem
Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if

a solution has not yet emerged

15. Dynamics, Str. IP (Pos.4):

a. Allow (or design) the characteristics of SUITCASE*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide SUITCASE* into parts that are capable of relative movement between each other.

c. If SUITCASE* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of SUITCASE* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

29. Controllable Soft Variables, Tac. IP (Pos.8):

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with SUITCASE* facilitating goal fulfillment of the function performed with S2 Object.

b. Make easier SUITCASE* interact with S2 Object using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving if a solution has not yet emerged

4. Asymmetry/ Symmetry, Str. IP (Pos.3):

a. Change the shape of SUITCASE* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.

b. If SUITCASE* is asymmetrical, increase its degree of asymmetry, or vice versa.

Separation principle for SUITCASE* : Separation in space

Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

COMPLEMENTARY CONTRADICTION 1
Contradiction order wt.5

Parameter to improve: (+) 7. Volume of moving object
TO IMPROVE (UDE): SUITCASE has More Own physical volume or accumulated quantitative volume or three-dimensional scope interacting with S2
Parameter to attenuate or preserve: (+) 25. Loss of Time
TO ATTENUATE OR PRESERVE (UDE): SUITCASE has More Loss of time or causes a bottleneck interacting with S2
Inventive principles IP(s) : [2,6,34,10]
2. Taking Out/ Adding, Str. IP (Pos.2):
a. Separate an interfering part or a property from SUITCASE*, or single out the only necessary part (or property) of SUITCASE*.
b. Add new parts or properties to SUITCASE*.
Separation principle for SUITCASE* : Separation in space

Solution strategy for SUITCASE* : Improving attributes

6. Universality, Tac. IP (Pos.18):

a. Make a part or the whole of SUITCASE* perform multiple functions.

b. Eliminate the need of SUITCASE* for others parts.

Separation principle for SUITCASE* : Separation alternative

Solution strategy for SUITCASE* : Improving if a solution has not yet emerged

34. Discarding and Recovering, Tac. IP (Pos.12):

a. Make portions of SUITCASE* , which have fulfilled their functions or are unnecessary, go away (discard by absorption, dissolving, evaporating, etc.).

b. Conversely, restore consumable parts of SUITCASE* directly in operation.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving if a solution has not yet emerged

10. Preliminary Action, Str. IP (Pos.1):

a. Perform the required change in, or for, SUITCASE*, before it is needed (either fully or partially).

b. Pre-arrange SUITCASE* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving attributes; Improving performance

COMPLEMENTARY CONTRADICTION 2
Contradiction order wt.7

Parameter to improve: (+) 1. Heaviness of moving object

TO IMPROVE (UDE): SUITCASE has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2

Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration

TO ATTENUATE OR PRESERVE (UDE): SUITCASE has Less Appropriate shape, composition, or configuration interacting with S2

Inventive principles IP(s) : [10,14,35,40]

10. Preliminary Action, Str. IP (Pos.1):

a. Perform the required change in, or for, SUITCASE*, before it is needed (either fully or partially).

b. Pre-arrange SUITCASE* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving attributes; Improving performance

14. Spheroidality – Curvature - Angle, Tac. IP (Pos.5):

a. For the interaction between SUITCASE* and S2 Object, instead of using rectilinear parts, surfaces, or shapes, use curvilinear, enveloping, or angled parts.

b. For the interaction between SUITCASE* and S2 Object, instead of acting in a linear or direct way, interact in an indirect way or with curvilinear, surrounding, or angled movements.

c. Move SUITCASE* from flat to spherical surfaces; from parts shaped as a cube (parallelepiped) to ball-shaped structures.

d. Use rolls, balls, spirals, domes in, or for, SUITCASE*.

e. Go from linear to rotary motion, use centrifugal forces in, or for, SUITCASE*.

f. If there is Spheroidality , curvature or angle, increase or reduce, as applicable, in, or for, SUITCASE*.

Separation principle for SUITCASE* : Separation alternative

Solution strategy for SUITCASE* : Improving attributes; Improving if a solution has not yet emerged

35. Transformation/ Parameter Changes, Str. IP (Pos.7):

a. Change SUITCASE*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

b. Change the composition or condition of SUITCASE* by adding or removing components.

c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of SUITCASE*.

Separation principle for SUITCASE* : Separation by condition / Separation alternative

Solution strategy for SUITCASE* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

40. Composite Materials/ Conditions, Oper. IP (Pos.21):

a. Change from a uniform material, property, state, or condition in, or for, SUITCASE* , to a composite one, or vice versa.

Separation principle for SUITCASE* : Separation by condition

Solution strategy for SUITCASE* : Improving attributes

COMPLEMENTARY CONTRADICTION 3

Contradiction order wt.9

Parameter to improve: (+) 33. Ease of operation

TO IMPROVE (DE): SUITCASE has More Desired ease of operation to interact with S2

Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration

TO ATTENUATE OR PRESERVE (UDE): SUITCASE has Less Appropriate shape, composition, or configuration interacting with S2

Inventive principles IP(s) : [15,34,29,28]

15. Dynamics, Str. IP (Pos.4):

a. Allow (or design) the characteristics of SUITCASE*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide SUITCASE* into parts that are capable of relative movement between each other.

c. If SUITCASE* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of SUITCASE* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

34. Discarding and Recovering, Tac. IP (Pos.12):

a. Make portions of SUITCASE* , which have fulfilled their functions or are unnecessary, go away (discard by absorption, dissolving, evaporating, etc.).

b. Conversely, restore consumable parts of SUITCASE* directly in operation.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving if a solution has not yet emerged

29. Controllable Soft Variables, Tac. IP (Pos.8):

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical,

magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with SUITCASE* facilitating goal fulfillment of the function performed with S2 Object.

b. Make easier SUITCASE* interact with S2 Object using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving if a solution has not yet emerged

28. Mechanics Substitution, Str. IP (Pos.13):

a. Replace a direct or manual action in, or for, SUITCASE*, with a mechanical action or a tool.

b. Replace a mechanical means in, or for, SUITCASE*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.

c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of SUITCASE*.

d. Change from static fields in, or for, SUITCASE* to moving fields, from unstructured fields to those with structure, or vice versa.

e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, SUITCASE*.

Separation principle for SUITCASE* : Separation by condition

Solution strategy for SUITCASE* : Improving attributes

COMPLEMENTARY CONTRADICTION 4

Contradiction order wt.14

Parameter to improve: (+) 25. Loss of Time

TO IMPROVE (UDE): SUITCASE has More Loss of time or causes a bottleneck interacting with S2

Parameter to attenuate or preserve: (-) 12. Shape / composition / configuration

TO ATTENUATE OR PRESERVE (UDE): SUITCASE has Less Appropriate shape, composition, or configuration interacting with S2

Inventive principles IP(s) : [4,10,34,17]

4. Asymmetry/ Symmetry, Str. IP (Pos.3):

a. Change the shape of SUITCASE* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.

b. If SUITCASE* is asymmetrical, increase its degree of asymmetry, or vice versa.

Separation principle for SUITCASE* : Separation in space

Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

10. Preliminary Action, Str. IP (Pos.1):

a. Perform the required change in, or for, SUITCASE*, before it is needed (either fully or partially).

b. Pre-arrange SUITCASE* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving attributes; Improving performance

34. Discarding and Recovering, Tac. IP (Pos.12):

a. Make portions of SUITCASE* , which have fulfilled their functions or are unnecessary, go away (discard

by absorption, dissolving, evaporating, etc.).

b. Conversely, restore consumable parts of SUITCASE* directly in operation.

Separation principle for SUITCASE* : Separation in time

Solution strategy for SUITCASE* : Improving if a solution has not yet emerged

17. Another Dimension or Field, Tac. IP (Pos.24):

a. Add or remove physical dimensions or fields of action of SUITCASE*.

b. Move SUITCASE* to a new dimension in space or performance field.

c. Use for SUITCASE* multi-story arrangement of objects instead of a single-story arrangement.

d. Tilt or re-orient SUITCASE*; lay it on its side.

e. Use another side of a given dimension or field of SUITCASE*.

Separation principle for SUITCASE* : Separation in space

Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

IX.B SOLUTION TO MORE RELEVANT CONTRADICTIONS BETWEEN NEEDS TO SATISFY (Cob.NS)

Included in each inventive principle described below is the incidence level or position number it occupies in Table II. If it is not shown, it means that it only appears in Table IV. and requires attention.

CONTRADICTION BETWEEN NEEDS TO SATISFY N° 1

Parameter to improve 33. Ease of operation

MEJORAR > SUITCASE tiene More Desired ease of operation to interact with S2

Parameter to preserve 27. Reliability

PRESERVAR > SUITCASE tiene más efecto deseable por párametro 27. Reliability

Inventive principles IP(s) : [17,27,8,40]

17. Another Dimension or Field, Tac. IP (Pos.24):

a. Add or remove physical dimensions or fields of action of SUITCASE*.

b. Move SUITCASE* to a new dimension in space or performance field.

c. Use for SUITCASE* multi-story arrangement of objects instead of a single-story arrangement.

d. Tilt or re-orient SUITCASE*; lay it on its side.

e. Use another side of a given dimension or field of SUITCASE*.

Separation principle for SUITCASE* : Separation in space

Solution strategy for SUITCASE* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

27. Cheap Short-Living Objects, Str. IP (Pos.):

a. Replace or divide (either fully or partially) SUITCASE* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.

b. Comprising certain qualities of SUITCASE* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.

Separation principle for SUITCASE* : Separation in subsystem

Solution strategy for SUITCASE* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

8. Anti-weight/ Compensation, Tac. IP (Pos.11):

a. To compensate for the heaviness/lightness or incidence of SUITCASE*, merge it with other objects or

independent own parts that provide an effect to improve the current situation.

b. To compensate for the heaviness/lightness or incidence of SUITCASE*, make it interact with the environment.

For example, compensate for the heaviness of SUITCASE* subject to a gravitational field, or exposed to a magnetic field, or subject to an economic value or price, or subject to a chemical bond, or subject to intellectual rigidity, a paradigm, or prejudices.

Separation principle for SUITCASE* : Separation alternative

Solution strategy for SUITCASE* : Improving attributes

40. Composite Materials/ Conditions, Oper. IP (Pos.21):

a. Change from a uniform material, property, state, or condition in, or for, SUITCASE* , to a composite one, or vice versa.

Separation principle for SUITCASE* : Separation by condition

Solution strategy for SUITCASE* : Improving attributes

Anexo

List of applicable Inventive Principles for Innovation Solutions

IP.1. Segmenting/ Integrating	IP.21. Skipping/ Avoiding
IP.2. Taking out/ Adding	IP.22. Convert harm in benefit
IP.3. Local Quality	IP.23. Feedback
IP.4. Asymmetry/ Symmetry	IP.24. Intermediary
IP.5. Merging/ Separating	IP.25. Self-service
IP.6. Universality	IP.26. Copying/ Replicating
IP.7. Nesting/ Dispersing	IP.27. Cheap Short-Living Objects
IP.8. Anti-Weight/ Compensation	IP.28. Mechanics Substitution
IP.9. Preliminary Anti-action	IP.29. Controllable Soft Variables
IP.10. Preliminary Action	IP.30. Simple Shapes/ Ways to Interact
IP.11. Beforehand Cushioning	IP.31. 31.Using/ Removing Unused Parts
IP.12. Equipotentiality	IP.32. Perception/ Appearance/ Color Changes
IP.13. Reverse or Indirect Action	IP.33. Homogeneity / Compatibility
IP.14. Spheroidality - Curvature - Angle	IP.34. Discarding and Recovering
IP.15. Dynamics	P.35. Transformation / Parameter Changes
IP.16. Partial or Excessive Actions	IP.36. Phase, State or Condition Transitions
IP.17. Another Dimension or Field	IP.37. Useful Perceptible Change
IP.18. Mechanical Vibrations/ Energy Variations	IP.38. Strong or Quick Reactions
IP.19. Time-Varying Action/ Periodic or Pulsating	IP.39. Inert Atmosphere / Environment

IP.20. Continuity of Useful Action	IP.40. Composite Materials/ Conditions

Available Aatrizinventor solutions: 0 - You can get more solutions in home page link.

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